Strong linear polarization detected in the cool active star II Peg

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Abstract

Magnetic fields of cool active stars are currently studied polarimetrically using only circular polarization observations. This provides limited information about the magnetic field geometry since circular polarization is only sensitive to the line-of-sight component of the magnetic field. Reconstructions of the magnetic field topology will therefore not be completely trustworthy when only circular polarization is used. On the other hand, linear polarization is sensitive to the transverse component of the magnetic field. By including linear polarization in the reconstruction the quality of the reconstructed magnetic map is dramatically improved. For that reason, we wanted to identify cool stars for which linear polarization could be detected at a level sufficient for magnetic imaging. Four active RS CVn binaries, II Peg, HR 1099, IM Peg, and sigma Gem were observed with the ESPaDOnS spectropolarimeter at the Canada-France-Hawaii Telescope. Mean polarization profiles in all four Stokes parameters were derived using the multi-line technique of least-squares deconvolution (LSD). Not only was linear polarization successfully detected in all four stars in at least one observation, but also, II Peg showed an extraordinarily strong linear polarization signature throughout all observations with LSD Stokes Q amplitudes reaching as high as 8*10^-4 I_c. This qualifies II Peg as the first promising target for magnetic Doppler imaging in all four Stokes parameters and, at the same time, suggests that other such targets can possibly be identified.

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